

1     CLAIMS:

2           1.     A thin profile battery bonding method comprising:  
3                 providing a curable adhesive composition comprising an epoxy  
4                 terminated silane;  
5                 providing a thin profile battery and a substrate to which the thin  
6                 profile battery is to be conductively connected;  
7                 interposing the curable adhesive composition between the thin  
8                 profile battery and the substrate; and  
9                 curing the adhesive into an electrically conductive bond electrically  
10                interconnecting the battery and the substrate.

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12           2.     The method of claim 1 wherein the epoxy terminated silane  
13                 comprises a glycidoxy methoxy silane.

14  
15           3.     The method of claim 1 wherein the epoxy terminated silane  
16                 comprises a glycidoxypropyltrimethoxysilane.

17  
18           4.     The method of claim 1 wherein the epoxy terminated silane  
19                 is present in the curable adhesive composition at less than or equal to  
20                 about 2% by weight.

21  
22           5.     The method of claim 1 wherein the epoxy terminated silane  
23                 is present in the curable adhesive composition at less than or equal to  
24                 about 1% by weight.

1           6.    The method of claim 1 wherein the thin profile battery  
2 comprises an outer nickel clad stainless steel surface over which the  
3 curable adhesive composition is received.  
4

5           7.    The method of claim 1 wherein the thin profile battery is  
6 a button type battery having a terminal housing member comprising an  
7 outer nickel clad stainless steel surface over which the curable adhesive  
8 composition is received.  
9

10          8.    The method of claim 1 wherein the thin profile battery is  
11 a button type battery having a terminal housing member comprising an  
12 outer nickel clad stainless steel surface over which the curable adhesive  
13 composition is received, and the substrate comprises conductive printed  
14 thick film ink over which the curable adhesive composition is received.  
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1           9.    A method of conductively interconnecting electronic  
2 components:

3           providing a curable adhesive composition comprising an epoxy  
4 terminated silane;

5           providing first and second electronic components to be conductively  
6 connected with one another;

7           interposing the curable adhesive composition between the first and  
8 second electronic components; and

9           curing the adhesive into an electrically conductive bond electrically  
10 interconnecting the first and second components.

11  
12           10. The method of claim 9 wherein at least one of the  
13 components comprises a nickel containing metal surface over which the  
14 curable adhesive composition is received.

15  
16           11. The method of claim 9 wherein the epoxy terminated silane  
17 comprises a glycidoxy methoxy silane.

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19           12. The method of claim 9 wherein the epoxy terminated silane  
20 comprises a glycidoxypropyltrimethoxysilane.

21  
22           13. The method of claim 9 wherein the epoxy terminated silane  
23 is present in the curable adhesive composition at less than or equal to  
24 about 2% by weight.

1           14. The method of claim 9 wherein the epoxy terminated silane  
2 is present in the curable adhesive composition at less than or equal to  
3 about 1% by weight.

4  
5           15. A thin profile battery bonding method comprising:  
6           interposing a curable epoxy composition between a thin profile  
7 battery and a substrate to which the thin profile battery is to be  
8 conductively connected, at least one of the battery and substrate  
9 comprising a metal surface with which the curable epoxy is to  
10 electrically connect; and

11           curing the epoxy into an electrically conductive bond electrically  
12 interconnecting the battery and the substrate, the epoxy having an  
13 effective metal surface wetting concentration of silane to form a cured  
14 electrical interconnection having a contact resistance through said metal  
15 surface of less than or equal to about  $0.3 \text{ ohm-cm}^2$ .

16  
17           16. The method of claim 15 wherein the epoxy has an effective  
18 metal surface wetting concentration of silane to form a cured electrical  
19 interconnection having a resistance through said metal surface of less  
20 than or equal to about  $0.16 \text{ ohm-cm}^2$ .

1           17. The method of claim 15 wherein the epoxy has an effective  
2 metal surface wetting concentration of silane to form a cured electrical  
3 interconnection having a resistance through said metal surface of less  
4 than or equal to about 0.032 ohm-cm<sup>2</sup>.

5  
6           18. The method of claim 15 wherein the metal surface wetting  
7 concentration of silane in the curable adhesive composition is less than  
8 or equal to about 2% by weight.

9  
10          19. The method of claim 15 wherein the metal surface wetting  
11 concentration of silane in the curable adhesive composition is less than  
12 or equal to about 1% by weight.

13  
14          20. The method of claim 15 wherein the thin profile battery has  
15 the metal surface and which comprises nickel clad stainless steel over  
16 which the curable adhesive composition is received.

17  
18          21. The method of claim 15 wherein the thin profile battery has  
19 the metal surface and is a button type battery having a terminal  
20 housing member comprising nickel clad stainless steel over which the  
21 curable adhesive composition is received.

22  
23          22. The method of claim 15 wherein the epoxy terminated silane  
24 comprises a glycidoxy methoxy silane.

1           23. A method of conductively interconnecting electronic  
2 components comprising:

3           interposing a curable epoxy composition between first and second  
4 electrically conductive components to be electrically interconnected, at  
5 least one of the components comprising a metal surface with which the  
6 curable epoxy is to electrically connect; and

7           curing the epoxy into an electrically conductive bond electrically  
8 interconnecting the first and second components, the epoxy having an  
9 effective metal surface wetting concentration of silane to form a cured  
10 electrical interconnection having a contact resistance through said metal  
11 surface of less than or equal to about  $0.3 \text{ ohm-cm}^2$ .

12  
13           24. The method of claim 23 wherein the epoxy has an effective  
14 metal surface wetting concentration of silane to form a cured electrical  
15 interconnection having a resistance through said metal surface of less  
16 than or equal to about  $0.16 \text{ ohm-cm}^2$ .

17  
18           25. The method of claim 23 wherein the epoxy has an effective  
19 metal surface wetting concentration of silane to form a cured electrical  
20 interconnection having a resistance through said metal surface of less  
21 than or equal to about  $0.032 \text{ ohm-cm}^2$ .

1           26. The method of claim 23 wherein the metal surface wetting  
2 concentration of silane in the curable adhesive composition is less than  
3 or equal to about 2% by weight.

4  
5           27. The method of claim 23 wherein the metal surface wetting  
6 concentration of silane in the curable adhesive composition is less than  
7 or equal to about 1% by weight.

8  
9           28. The method of claim 23 wherein the metal surface  
10 comprises nickel over which the curable adhesive composition is  
11 received.

12  
13           29. A battery powerable apparatus comprising:  
14 a substrate having a surface comprising at least one node location;  
15 a thin profile battery mounted over the substrate and node  
16 location; and  
17 a conductive adhesive mass electrically interconnecting the thin  
18 profile battery with the node location, the conductive adhesive mass  
19 comprising an epoxy terminated silane.

20  
21           30. The apparatus of claim 29 wherein the epoxy terminated  
22 silane comprises a glycidoxy methoxy silane.

1           31. The apparatus of claim 29 wherein the epoxy terminated  
2           silane comprises a glycidoxypropyltrimethoxysilane.

3  
4           32. The apparatus of claim 29 wherein the epoxy terminated  
5           silane is present in the adhesive mass at less than or equal to about  
6           2% by weight.

7  
8           33. The apparatus of claim 29 wherein the epoxy terminated  
9           silane is present in the adhesive mass at less than or equal to about  
10          1% by weight.

11  
12          34. The apparatus of claim 29 wherein the thin profile battery  
13          comprises an outer nickel clad stainless steel surface over which the  
14          conductive adhesive mass is received.

15  
16          35. The apparatus of claim 29 wherein the thin profile battery  
17          is a button type battery having a terminal housing member comprising  
18          an outer nickel clad stainless steel surface over which the conductive  
19          adhesive mass is received.



1           36. The apparatus of claim 29 wherein the thin profile battery  
2 is a button type battery having a terminal housing member comprising  
3 an outer nickel clad stainless steel surface over which the conductive  
4 adhesive mass is received, and the substrate comprises conductive  
5 printed thick film ink over which the conductive adhesive mass is  
6 received.

8           37. A radio frequency communication device comprising:  
9 a substrate having conductive paths including an antenna;  
10 at least one integrated circuit chip mounted to the substrate and  
11 in electrical connection with a first portion of the substrate conductive  
12 paths; and

13 a thin profile battery conductively bonded with a second portion  
14 of the substrate conductive paths by a conductive adhesive mass, the  
15 conductive adhesive mass comprising an epoxy terminated silane.

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17           38. The device of claim 37 wherein the epoxy terminated silane  
18 comprises a glycidoxymethoxy silane.

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20           39. The device of claim 37 wherein the epoxy terminated silane  
21 comprises a glycidoxypropyltrimethoxysilane.  
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1           40. The device of claim 37 wherein the epoxy terminated silane  
2 is present in the adhesive mass at less than or equal to about 2% by  
3 weight.

4  
5           41. The device of claim 37 wherein the epoxy terminated silane  
6 is present in the adhesive mass at less than or equal to about 1% by  
- weight.

8  
9           42. The device of claim 37 wherein the thin profile battery  
10 comprises an outer nickel clad stainless steel surface over which the  
11 conductive adhesive mass is received.

12  
13           43. The device of claim 37 wherein the thin profile battery is  
14 a button type battery having a terminal housing member comprising an  
15 outer nickel clad stainless steel surface over which the conductive  
16 adhesive mass is received.

17  
18           44. The device of claim 37 wherein the thin profile battery is  
19 a button type battery having a terminal housing member comprising an  
20 outer nickel clad stainless steel surface over which the conductive  
21 adhesive mass is received, and the conductive paths comprise conductive  
22 printed thick film ink over the second portion of which the conductive  
23 adhesive mass is received.  
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1           45. An electric circuit comprising first and second electric  
2 components electrically connected with one another through a conductive  
3 adhesive mass comprising an epoxy terminated silane.

4  
5           46. The electric circuitry of claim 45 wherein the epoxy  
6 terminated silane comprises a glycidoxymethoxysilane.

7  
8           47. The apparatus of claim 45 wherein the epoxy terminated  
9 silane comprises a glycidoxypolytrimethoxysilane.

10  
11           48. The apparatus of claim 45 wherein the epoxy terminated  
12 silane is present in the adhesive mass at less than or equal to about  
13 2% by weight.

14  
15           49. The apparatus of claim 45 wherein the epoxy terminated  
16 silane is present in the adhesive mass at less than or equal to about  
17 1% by weight.

18  
19           50. The apparatus of claim 45 wherein at least one of the first  
20 and second electric components comprises a nickel containing metal  
21 surface over which the conductive adhesive mass is received.